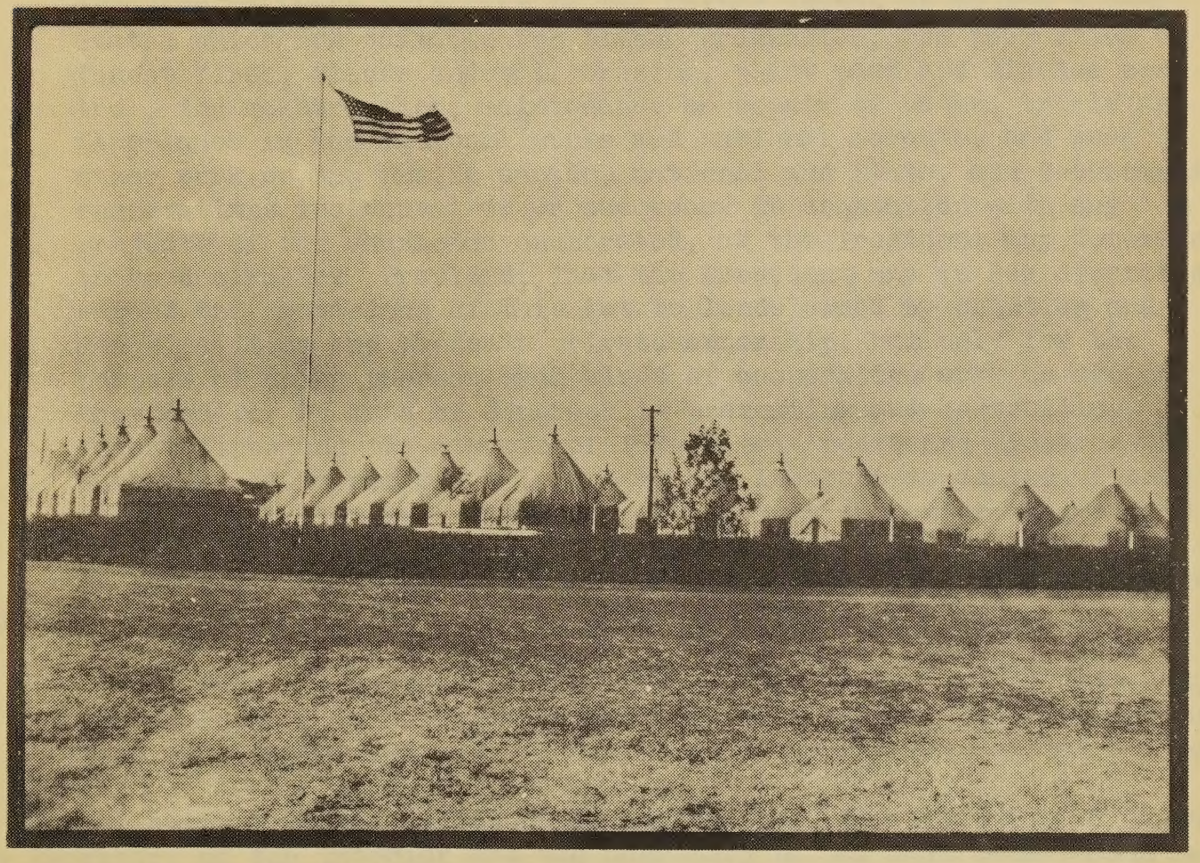
WORK OF THE E.C.W. SOIL EROSION CAMPS IN ALABAMA, MISSISSIPPI, OKLAHOMA AND TEXAS



AN E.C.W. SOIL EROSION CAMP AT COOLIDGE, TEXAS

By W. D. Ellison, Assistant Drainage Engineer,
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Forest Service
U.S. Department of Agriculture
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INTRODUCTION

Authorization and Organization

Conservation of soil and flood prevention is the objective of twenty-nine Erosion Camps functioning in Alabama, Mississippi, Oklahoma and Texas under President Roosevelt's Emergency Conservation Work Program. The Act authorizing this work (S. 598 - 73d Congress) reads:

> "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of relieving the acute condition of widespread distress and unemployment now existing in the United States, and in order to provide for the restoration of the country's depleted natural resources and the advancement of an orderly program of useful public works, the President is authorized, under such rules and regulations as he may prescribe and by utilizing such existing departments or agencies as he may designate, to provide for employing citizens of the United States who are unemployed, in the construction, maintenance and carrying on of works of a public nature in connection with the forestation of lands belonging to the United States or to the several States which are suitable for timber production, the prevention of forest fires, floods and soil erosion, plant pest and disease control, the construction, maintenance or repair of paths, trails and fire-lanes in the national parks and national forests, and such other work on the public domain, national and State, and Government reservations incidental to or necessary in connection with any projects of the character enumerated, as the President may determine to be desirable: Provided, That the President may in his discretion extend the provisions of this Act to lands owned by counties and municipalities and lands in private ownership, but only for the purpose of doing thereon such kinds of cooperative work as are now provided for by Acts of Congress in preventing and controlling forest fires and the attacks of forest tree pests and diseases and such work as is necessary in the public interest to control floods ----------"

On April 5, 1933 President Roosevelt issued the following Executive Order:

> "For the purpose of carrying out the provisions of this Act, Robert Fechner is hereby appointed Director of Emergency Conservation Work ----------"

Following this the Secretary of Agriculture, the Secretary of Labor, the Secretary of the Interior and the Secretary of War were each authorized to appoint a representative, forming an Advisory Council to the Director.

The Director of Emergency Conservation Work placed the general administration of the "erosion" camps under the U. S. Forest Service. To assist in establishing a policy and in supervising the engineering work, the U. S. Bureau of Agricultural Engineering is working with the Forest Service. To the Army has been assigned the job of providing shelter, bedding, food, medical facilities and the care of camps.

(Over)

The Forest Service has delegated actual organization and administration of the projects to State Agencies. In Alabama, Mississippi and Oklahoma administration of the work is under the State Foresters. Extension engineers of the State Colleges are supervising the engineering work. In Texas the administration of the "erosion" camps is under the Extension Engineer of the State College and the supervision of engineering work is under a Technician hired by E.C.W. A capable engineer is in charge of the engineering phase of the work at each camp, working directly under the Extension Engineer or the Technician. Likewise foresters are in charge of the tree planting work which assumes largest importance east of the Mississippi River.

Administration of these camps, together with all other E.C.W. camps working on State and private lands in the Gulf States Forest Service District, comes under the jurisdiction of the District Forest Inspector, at New Orleans.

The Act authorizing this work specifically states that all this work must be in the public interest. Although these 29 camps are performing work mostly on privately owned lands the erosion control work is of public benefit because it is aiding in conserving the productive capacity of the nation and preventing the rapid accumulation of silt deposits in small streams and rivers. The silting up of streams is accumulative, as is the action of erosion in many places, and if these are permitted to continue unchecked they will set up flood hazards in many communities and affect many properties. In some of the older farming regions where such conservation measures have not been taken, millions of acres of good lands have been laid in waste by erosion. Floods in these sections are more frequent and severe due to filling of streams by soil carried down from the uplands.

The erosion control problem in these four states is of such magnitude that the 5,000 to 6,000 boys engaged will make but slight gains on the total amount of work to be done. However, they are setting up a large number of practical demonstrations which will serve for the guidance of land owners desirous of conserving their farms. Too, many of these boys will return to farms some day with a desire to work on their own lands or that of their parents, and they will be thoroughly qualified to disseminate information by setting up demonstrations on these lands. All these facts are worthy of consideration when the merit of the work from purely a public interest standpoint is being observed.

METHODS OF CONTROL

The objective of this work is to provide permanent public improvements for checking erosion in gullies and preventing gully formation. This consists of (1) Healing the gullies by means of planting trees, vines, or grasses, with the aid of small temporary check dams, and (2) Constructing permanent dams.

Practical demonstrations of controlling gullies with the construction of small temporary check dams and the planting of black locust were established some 20 years ago in western Tennessee by Mr. R. S. Maddox, State Forester at that time.

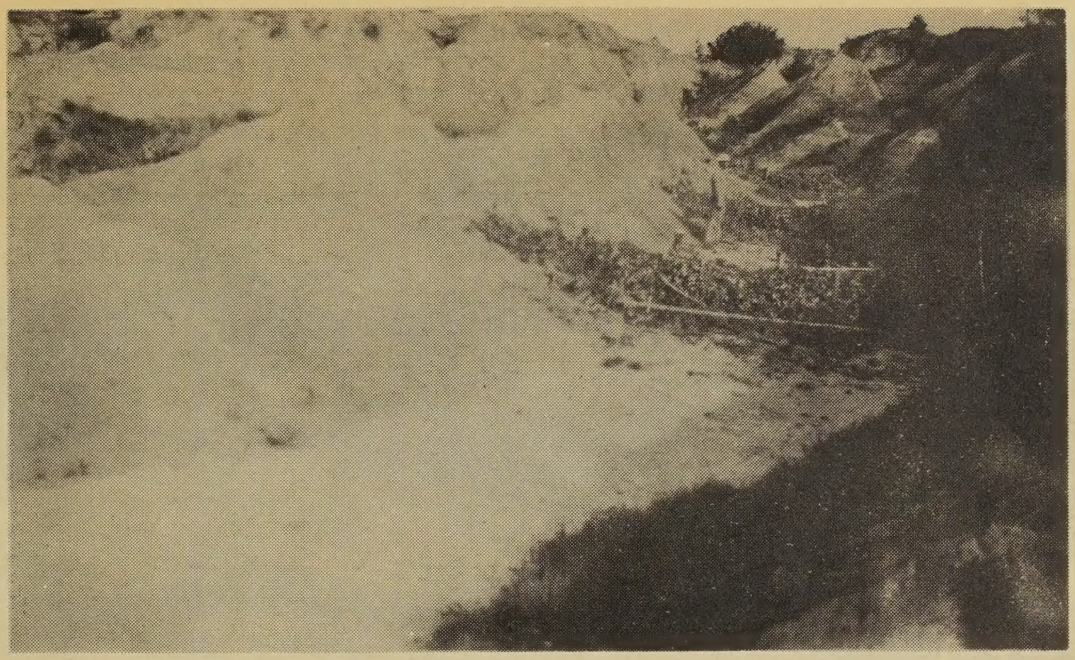

Fig. 1. - Preparing a gully for planting trees. The check dams have been built; the next step is to work down fertile topsoil from the upper edges of the banks by plowing or blasting, to fill behind dams. (Scene near Holly Spring,Miss.)

Fig. 2. - Gully which has been completely healed by planting black locust trees. Brush check dams were built, the banks plowed down, and in early spring small locust seedlings planted.

Fig. 3. - Road closed by gully erosion. Gully 80 feet wide, 25 feet deep and increasing rapidly. Channel area required, about 80 square feet cross-section. (Near Rush Springs, Okla.)

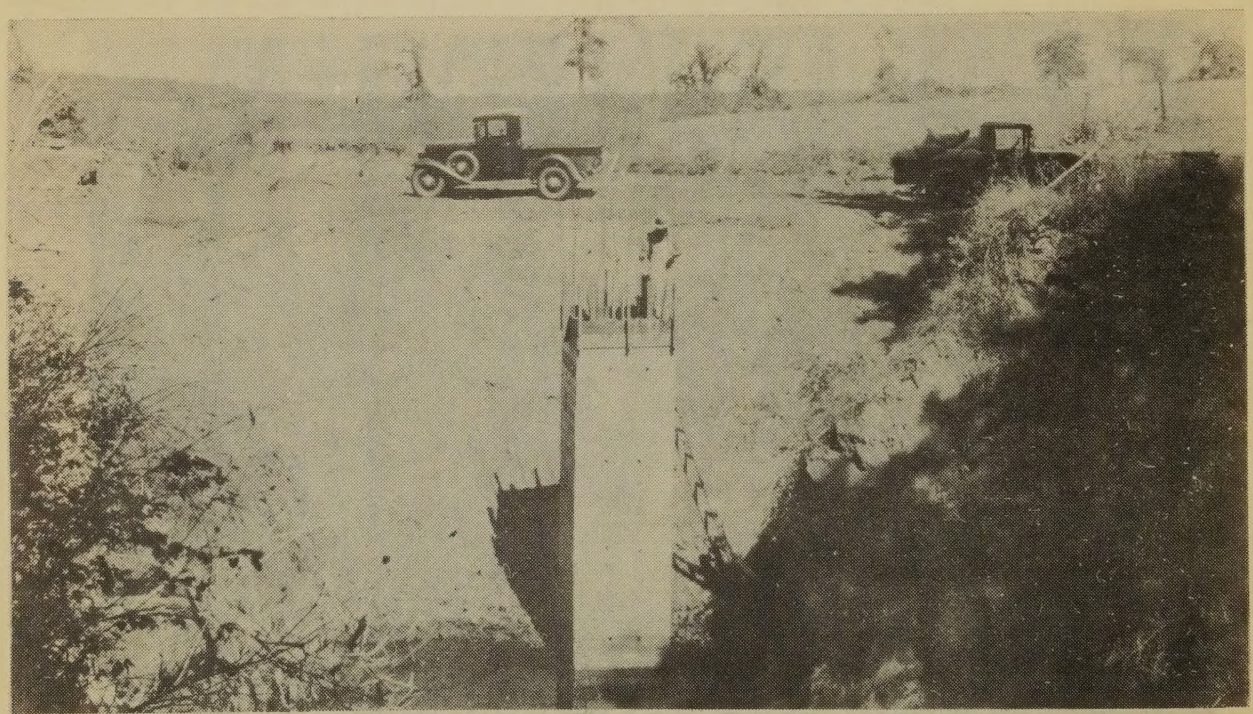

Fig. 4. - Road opened by E.C.W. Erosion camp. This soil-saving dam serves a dual purpose as highway bridge and as a means of preventing the gully from advancing $\frac{1}{2}$ to $\frac{3}{4}$ mile across good farm lands. (Near Rush Springs, Okla.)

Information on dam construction for erosion control purposes is based largely on data compiled by the U. S. Bureau of Agricultural Engineering over a long period of years. These studies and experiments were made in a number of states and compilations and reports on these data have been prepared by Mr. C. E. Ramser, Senior Drainage Engineer with the Agricultural Engineering Bureau.

These two primary methods of gully erosion control are seldom overlapping in their application. Permanent dams can not often be successfully substituted for tree planting, nor can planting often be substituted for permanent dam construction. Planting is most successfully carried on where small drainage areas are involved. Large quantities of water flowing down a gully in highly erosive soil make it very difficult to revegetate the entire gully perimeter with trees or grasses. Vegetation is usually destroyed before the soil can be bound with a good root system. Climatic conditions must always be considered when studying gully control problems for long continued droughts may prevent successful gully planting. Disregarding climate considerations, the success of erosion control by planting can only be assured where there is a relatively shallow, slow flow and where large quantities of water are not concentrated above points of high overfall.

On gullies having large watersheds and for the control of permanent waterways in cultivated fields, permanent dams are used.

The entire program of soil and stream conservation may be divided into three classes of work. These are -

(1) Work which has for its main purpose the protection of bottom lands and streams from ruinous soil deposits carried down from gullies.

(2) Work to stop advance of gullies which if unstopped would destroy valuable lands and other properties and deposit large quantities of soil in drainage systems, thereby adding to flood stages.

(3) Work which has for its purpose the control of erosion in permanent water courses, maintaining the proper cross-section, and preventing gully formation.

WORK OF THE CAMPS

1. Protection of Streams and Bottom Lands

In northern Mississippi ten "erosion" camps are located on the Tallahatchie River watershed. This old farming region is so badly gullied that a large part of it can no longer be farmed. Deep gullies are so numerous that it is very difficult to construct highways across many sections and the roads wind a tortuous trail across hilltops between heads of gullies which have reached the tops of their watersheds extending up either side of the ridges. Thus little or no water enters at the heads and further extension of the gullies is not a problem to contend with.

Small lateral extensions and sand washed from all portions of the bottoms and sides continue to make the problem of sand transported over the bottom lands and into the streams a matter of first importance. In these gullies small brush and wire dams are being constructed and the gullies planted to trees. The roots of the trees will bind the soil to check erosion and the trees growing in the gully channel will reduce velocities and cause most of the soil being transported to be deposited in the gullies before the water reaches the lowlands.

Figure 1 shows a large gully with small brush and wire dams constructed. These dams are low, only 18 to 24 inches in height, so that there will be little overfall at the dam sites after the vegetation has reclaimed the gullies and the dams are gone. Each dam has a brush apron well underlaid with straw, and the spacing is such that the maximum grade between dams is one per cent. The bottoms of these gullies are mostly sterile sand and the topsoil must be worked down from the tops of the banks to fill behind the dams before any planting is done. This soil is worked down either by plowing or blasting. On gullies 20 feet or more deep blasting has been found to be most economical. Planting will be done in the spring season.

Figure 2 shows a gully completely healed-over and stopped by the planting a few years ago of black locust seedlings. Brush dams, similar to those shown in Figure 1, were built and the banks sloped before the trees were planted.

Two E.C.W. nurseries have been established in northern Mississippi and 7 to 9 million black locust seedlings will be available for spring planting in 1934. To supplement this planting, other seedlings, root cuttings and grass (particularly Bermuda grass) that can be collected locally will be used.

2. Checking Advance of Gullies

In checking the advance of gullies there are two methods of attack. Either a permanent dam is constructed at the head of the gully to drop the water from the ground surface to the gully bottom, or all water is diverted away and out of the gully.

Dams at gully heads are either of the drop-inlet type or the weir-notch type. Figure 4 shows a dam of the drop-inlet type where the top of the earth fill is used as a highway across the gully. This 4 by 4 foot concrete box culvert virtually replaces a wooden trestle highway bridge about 100 feet long. A gully crossing a highway that continues to grow larger often necessitates frequent bridge replacements. A soil saving dam of the type shown in Figure 4 is a permanent solution of the trouble. The camps do not work on strictly highway problems for their aim is soil conservation for flood control purposes. If this gully had not been checked at the roadway, it would have extended 1/2 to 3/4 mile up the watershed across good agricultural lands. The County cooperated on this project, appropriating about $500 for purchase of materials and furnishing equipment for making the large earth fill. The camp engineers took charge and supplied the labor. The completed job serves a dual purpose in conserving both highway and agricultural lands. A number of structures of this type have been built and plans are complete for a large additional number.

Fig. 5. - Here a gully was endangering farm buildings. Under direction of E.C.W. engineers terraces were continued across barnyard and pasture below buildings. Terrace construction done by the farmer, check dam construction by camp. (Near Cleburne, Tex.)

Fig. 6. - Formerly this was a county road. Since used as a terrace outlet it has been rapidly growing into a gully. Check dams built by E.C.W. camp. (Near Cleburne, Tex.)

Fig. 7. - Terraces formerly discharged into roadside ditch and caused gully erosion along roadside and in terrace ends. New ditch constructed by farmers under supervision of E.C.W. Engineers. Check dams constructed by camp. (Near Cleburne, Tex.)

Fig. 8. - A series of check dams constructed by E.C.W. Camp. In the background the farmer is seen working on terraces, bringing them up to standard dimensions. (Near Wewoka, Okla.)

The camp at Rush Springs, Oklahoma has six of them planned, all located to serve a dual purpose in that they replace old broken down highway bridges and stop the advance of gullies.

By diverting water out of a large gully the points where overfall formerly occurred can be vegetated and active erosion will be checked. This diversion is accomplished either by constructing an intercepting channel to take the water from the head of the gully or by terracing the watershed to carry the water to another channel.

If an intercepting ditch is constructed it must be protected against erosion. For this purpose either permanent dams are used or the ditch is well vegetated. In connection with starting a growth of grass in these ditches the U. S. Bureau of Agricultural Engineering has had very good success on some if its erosion experiment farms. Ditches are dug wide and shallow, approximately a foot of width for each acre draining, and creosoted baffles, 2" x 12" plank, are set with the upper edge of the plank flush with the bottom of the channel. Spacing of the baffles will depend on the grade of the ditch. These baffles keep the flow spread and prevent gullying in the bottom of the channel. Baffles are also continued up the channel side slopes. Some of the camps are using this method of control in diversion ditches.

A gully need not be waste land on a farm, for after the water is diverted from it, trees can be successfully planted which will produce fence posts or other valuable timber products. In the better agricultural areas in this District such planting does not comprise a part of the erosion control program unless active erosion is likely to continue after the water is diverted. However, in every case the farmers are advised on how to utilize the old gullies by planting trees, vines, and grasses for it is better that they be planted to provide against future emergencies such as diversion ditch or terrace failures.

3. Prevention of Gully Formation

A large part of this work is cooperative, with the farmers and land owners. Gully erosion which occurs at the terrace outlets is being checked and the terracing systems are being made effective. Terracing, aside from being a very effective means of diverting water out of large gullies, is the only positive way of absolutely preventing gully formation on cultivated lands. A completed system of terraces on a cultivated field may prevent the formation of a large number of gullies. However, since terraces divert and concentrate water at high levels the outlet ditches, into which the terraces discharge, necessarily have steep grades for they must extend from the highest to the lowest points on the watersheds. Unless measures are taken to control erosion in these outlet ditches, gully erosion is certain to follow. After a large gully is formed at the outlet the overfall created at the ends of the terraces will cause gullies to extend up each terrace channel. Often entire fields or large parts of fields are completely destroyed for farming purposes by erosion which starts in the outlet ditches. Measures to check this erosion at terrace outlets now comprise a large part of the camp work in Alabama, Oklahoma and Texas for they are all located in relatively good farming districts.

The camps do not construct terraces nor do they dig the outlet ditches. The land owners are required to do this construction and the camps construct the erosion control dams which cause the water to pass from the terraces at non-erosive grades down the outlet ditches and discharge into the drainage channels in the valleys free of excessive silt burdens. In order to make their programs most effective the camp engineers survey, plan and stake out the work, including the terraces and the outlet ditches. In some states county road machinery is available to the farmers to construct their terraces and ditches. Farmers pay only for gasoline and oil used and pay the salaries of machine operators.

In Figure 5 is shown a terrace outlet that passed through the corner of a barnyard and gully erosion was so active that foundations of all buildings were endangered. Surveys were made by camp engineers and plans provided to continue field terraces across the barnyard and pasture below the buildings. The old gully was crossed with a terrace (the two lower terraces not complete at the time photograph was taken) and low check dams were set at a high level, at one side of the old gully, to prevent further erosion about the buildings. This is a fine demonstration of good engineering practice in erosion control work. It is much less costly to make earth fills in the old gully than to construct check dams in it. Through this method the land owner has greatly assisted by using horsepower available on his farm. He has a great interest in the job and will perhaps protect it with better maintenance than if he had not greatly assisted in the construction. On all jobs the farmers are required to do all work not requiring a large amount of hand labor. If an outlet ditch has become a large gully, too large to be easily controlled with dams, surveys are made by the camp engineers and a new ditch is staked. After construction has been completed by the farmer the camps install the erosion control works.

The outlet ditch shown in Figure 6 was formerly an old roadway. Early practices in terracing were to discharge water into roadways wherever possible. This has proven troublesome and costly to highway departments and camps are now insisting that outlet ditches be located in the fields or along property lines away from the highways.

The terraces shown in Figure 7 formerly discharged into a roadside ditch, a large gully was forming and gully erosion was extending back along the terrace channels. The camp engineers designed and staked a new ditch and after the farmer had constructed it the camp installed the check dams shown. One dam is set in the outlet ditch on each terrace line, with the notch on the grade of the terrace channel and the headwall extending into the terrace ridge. A broad crest levee or terrace is thrown up along the ditch on the side opposite the terraces and the headwall of the dam extended into this. Intermediate dams are used between terraces to reduce dam heights and the depth of ditch required. By using intermediate dams effective heights of structures usually range from 1-1/2 to 2 feet and two of these with low effective heights can be constructed more cheaply than one dam 3-1/2 to 4 feet high. Too, low dams afford a shallow ditch that will interfere little with farming operations.

Figure 8 shows a dam where structures were set on terrace lines only. This practice is being discontinued in favor of the lower dams for reasons just mentioned.

Where it is possible to use one ditch as a common outlet for two or more farms, farmers must agree to use it as such. All openings in structures are made sufficiently large to drain all lands that are or will later be terraced to the ditch. Figure 9 shows a gully on a fence line now controlled to drain terraces from both sides of the fence.

Work on terrace outlet ditches is done only where the terraces are well constructed and measure up to reasonably safe standards. Height, width of base, vertical interval and grades of terrace channels are the dimensions considered. These dimensions vary with changes in soils and climatic conditions. In Figure 10 a farmer is seen rebuilding his terraces and bringing them up to standard dimensions. A check dam in the outlet ditch can be seen in the foreground.

Terracing is not a part of the camp work, but cooperating with the farmer by surveying, planning and staking his terraces and outlet ditches, and controlling gully erosion so that it will not undermine and destroy the farmer's entire erosion control project comprises a large part of the work of camps in the farming sections. Through this program great momentum is given to the terracing movement. Many farmers can be seen near each camp constructing substantial terraces that are well planned by the camp engineers. The camps are following this work up with structures that convey the water from the terraces down non-erosive grades, passing it from the rolling cultivated hilltops, free of excessive silt burdens, to the drainage channels in the valleys. Land owners never quite understood before just how this job should be done, they now understand and they see the purpose and the value of the camps, and they are cooperating.

WORK POLICIES

(1) Conservation and not reclamation is the objective of E.C.W. erosion camps in Alabama, Mississippi, Oklahoma and Texas. No work is done which has for its only purpose the reclamation of a gully for future agricultural crop use.

(2) Gullies in severely eroded lands such as those in northern Mississippi are being stopped or healed by means of building check dams, sloping off the banks, and planting black locust trees, vines or grasses.

(3) After water has been diverted from a gully by a diversion ditch or terracing system, if erosion is likely to continue quite actively, the gully is planted by the camp. If active erosion does not continue the job of planting is left to the land owner and he is instructed by the camp how to plant the gully area to produce fence posts and other valuable timber products.

(4) E.C.W. "erosion" camps are hand labor organizations. They work only on jobs requiring engineering or forestry planning, technical supervision and hand labor. Land owners are required to do all work that can be done with teams, tractors and machinery in preparing their lands for the camp work that follows.

(5) Roadside ditches are not being used as terrace outlet channels. Control of these as outlet channels is both difficult and costly.

(6) Wide shallow ditches are used as terrace outlets. These have intermediate structures between terrace lines and are of such design that they will interfere little with farming operations.

(7) Farmers must agree to use ditches that are on or very near property lines as common outlets and openings in all structures are made of sufficient size to drain all lands that are terraced or will later be terraced to the ditch.

(8) Where farmers are cooperating in the conservation program by terracing their lands, certain standards of terrace construction are required by the camps before any work is done on outlet ditches. Height of terrace, width of base, grade of channel and vertical spacing are the measurements considered. These elements vary with the soils, topography and climatic changes.

Fig. 9. - Terrace outlet ditch along fence line. Terraces from both sides of fence meet at common point and dams constructed by E.C.W. Camp are sufficient to care for water from both sides of fence. (Near Wewoka, Okla.)

Fig. 10. - Note check dam constructed by E.C.W. camp in left foreground. Many farmers in the vicinity of the erosion camps are rebuilding their terraces to standard dimensions, as requested by E.C.W. Engineers. (Near Wewoka, Okla.)